

The Falcon and the Dragon

AN INFOGRAPHIC BY James Round

IN July 1969, Neil Armstrong stepped out of the relative safety of his spacecraft and made cautious first steps over the surface of the moon, as 600 million people back on Earth watched on in wonder. It was the defining moment of a generation, the new dawn of an age of space travel. Unfortunately, over the next 50 years those dreams were never quite realised. Somewhere along the way we lost our appetite for space. After 1972, we never went back to the moon.

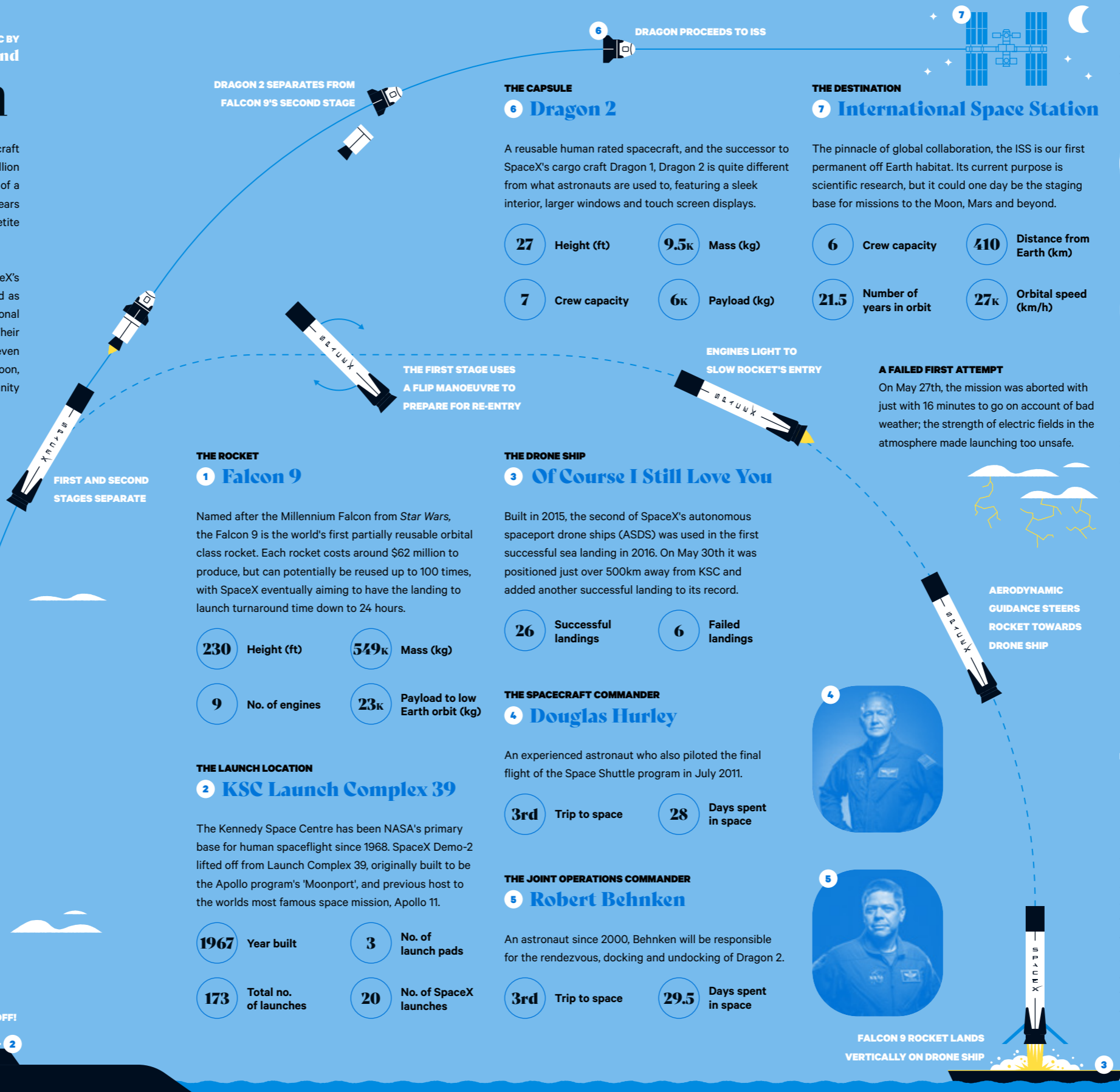
However now perhaps that dawn beckons once more. On May 30th 2020, SpaceX's Dragon 2 made history as the first ever human crewed commercial spacecraft. And as Douglas Hurley and Robert Behnken orbited around the Earth towards the International Space Station, they christened their spacecraft with a new name, *Endeavour*. Their historic journey to the ISS lasted around 19 hours, but it represents the start of an even longer one. It's the beginning of an adventure that could take humans back to the Moon, see men and women take new cautious first steps on Mars, and one day lead humanity towards the most ambitious endeavour of all; becoming a multi-planetary species.

Every second counts Key moments in the launch countdown

- 45 MINUTES TO LAUNCH**
Launch director verifies go for propellant load
- 42 MINUTES TO LAUNCH**
The crew access arm retracts from Dragon
- 37 MINUTES TO LAUNCH**
Dragon's launch escape system is armed
- 35 MINUTES TO LAUNCH**
Kerosene and liquid oxygen loading begins
- 16 MINUTES TO LAUNCH**
Second stage liquid oxygen loading begins
- 7 MINUTES TO LAUNCH**
Falcon 9 begins engine chill prior to launch
- 5 MINUTES TO LAUNCH**
Dragon transitions to internal power
- 1 MINUTE TO LAUNCH**
Command flight begins final prelaunch checks
- 45 SECONDS TO LAUNCH**
Launch director verifies go for launch
- 3 SECONDS TO LAUNCH**
Engine controller commands engine ignition sequence to start

How SpaceX won the new space race

- MAY 2002**
SpaceX is founded
The company is started by Elon Musk, with the vision of creating a long term settlement on Mars.
- JULY 2011**
The end of an era
Atlantis lands at the Kennedy Space Centre, the 135th and final mission of NASA's Space Shuttle program.
- MAY 2012**
Welcome to the ISS
SpaceX becomes the first private company to launch a spacecraft to the International Space Station.
- SEPTEMBER 2014**
Partners in flying
NASA awards contracts to SpaceX (\$2.6 billion) and Boeing (\$4.2 billion) to transport astronauts to the ISS.
- MARCH 2019**
SpaceX Demo-1
SpaceX becomes the first private company to send a human rated spacecraft into space.
- MAY 2020**
A great endeavour
SpaceX successfully completes a crewed mission to the International Space Station.



THE ROCKET

1 Falcon 9
Named after the Millennium Falcon from *Star Wars*, the Falcon 9 is the world's first partially reusable orbital class rocket. Each rocket costs around \$62 million to produce, but can potentially be reused up to 100 times, with SpaceX eventually aiming to have the landing to launch turnaround time down to 24 hours.

- 230** Height (ft)
- 549k** Mass (kg)
- 9** No. of engines
- 23k** Payload to low Earth orbit (kg)

THE LAUNCH LOCATION

2 KSC Launch Complex 39
The Kennedy Space Centre has been NASA's primary base for human spaceflight since 1968. SpaceX Demo-2 lifted off from Launch Complex 39, originally built to be the Apollo program's 'Moonport', and previous host to the world's most famous space mission, Apollo 11.

- 1967** Year built
- 3** No. of launch pads
- 173** Total no. of launches
- 20** No. of SpaceX launches

THE CAPSULE

6 Dragon 2
A reusable human rated spacecraft, and the successor to SpaceX's cargo craft Dragon 1, Dragon 2 is quite different from what astronauts are used to, featuring a sleek interior, larger windows and touch screen displays.

- 27** Height (ft)
- 9.5k** Mass (kg)
- 7** Crew capacity
- 6k** Payload (kg)

THE DESTINATION

7 International Space Station
The pinnacle of global collaboration, the ISS is our first permanent off Earth habitat. Its current purpose is scientific research, but it could one day be the staging base for missions to the Moon, Mars and beyond.

- 6** Crew capacity
- 410** Distance from Earth (km)
- 21.5** Number of years in orbit
- 27k** Orbital speed (km/h)

THE DRONE SHIP

3 Of Course I Still Love You
Built in 2015, the second of SpaceX's autonomous spaceport drone ships (ASDS) was used in the first successful sea landing in 2016. On May 30th it was positioned just over 500km away from KSC and added another successful landing to its record.

- 26** Successful landings
- 6** Failed landings

THE SPACECRAFT COMMANDER

4 Douglas Hurley
An experienced astronaut who also piloted the final flight of the Space Shuttle program in July 2011.

- 3rd** Trip to space
- 28** Days spent in space

THE JOINT OPERATIONS COMMANDER

5 Robert Behnken
An astronaut since 2000, Behnken will be responsible for the rendezvous, docking and undocking of Dragon 2.

- 3rd** Trip to space
- 29.5** Days spent in space

A FAILED FIRST ATTEMPT

On May 27th, the mission was aborted with just 16 minutes to go on account of bad weather; the strength of electric fields in the atmosphere made launching too unsafe.

How dangerous was the mission?

For each mission NASA calculates two probabilities. One accounts for the loss of the crew (LOC), the other for the loss of the mission (but where the crew survives).

- Loss of Crew SpaceX Demo-2**
1-in-276
- Loss of Mission SpaceX Demo-2**
1-in-60
- Loss of Crew Space Shuttle**
1-in-90

At the end of the Space Shuttle program, with two fatal accidents behind them, NASA calculated that the LOC risk for any future mission was simply too great to justify.

How many times has SpaceX successfully landed a Falcon?

Since 2013, SpaceX has been perfecting the Falcon and Falcon Heavy landings, both on land and at sea.

- 19** Ground Pad
- 33** Drone Ship
- 1** Failed Ground Pad
- 9** Failed Drone Ship

Note: Data does not include launches that made no attempt to land, or attempted to land in the ocean itself.

What happens next?

After the success of the Demo-2 mission, SpaceX already has a number of future missions planned. Later this year it will transport a crew of four astronauts to the ISS. And in 2021/22 it will launch the *Axiom Space Mission*, the first fully private flight to the ISS, and the *Space Adventure Mission*, which will see space tourists fly a three to five day elliptical orbit around the Earth, travelling higher than the record set by Gemini 11 in 1966.

Sources: Wikipedia, BBC, NASA, SpaceX, The Verge, spaceflightnow.com and www.spacexfleet.com. Data correct as of 31st May 2020.